

DO NOT OPEN THIS TEST BOOKLET TILL YOU ARE ASKED TO DO SO.

TR/TES/Elect-II/M/Degree-V(A)/24

Test Booklet Series

**TEST BOOKLET
ELECTRICAL ENGINEERING
PAPER-II**

B

(Signature of the Candidate)

(Invigilator's Signature)

Time allowed – 3 hours (Three hours)

Maximum Marks – 200

INSTRUCTIONS

1. IMMEDIATELY BEFORE THE COMMENCEMENT OF THE EXAMINATION, YOU SHOULD CHECK THAT THIS TEST BOOKLET DOES NOT HAVE ANY UNPRINTED OR TORN OR MISSING PAGES OR ITEMS ETC. IF SO, GET IT REPLACED BY TEST BOOKLET OF SAME SERIES.
2. ENCODE CLEARLY THE TEST BOOKLET SERIES IN THE OMR ANSWER SHEET ONLY IN THE APPROPRIATE PLACE IN THE ANSWER SHEET BY BLACK BALL POINT PEN ONLY.
3. This Test Booklet is divided into three SECTIONS i.e., SECTION-A, SECTION-B and SECTION-C.
 - (A) **SECTION-A (MCQ Pattern)** contains 40 items (questions). Each question carrying 2(two) marks only, has four responses (answers). You will select the response which you want to mark on the OMR Sheet. In case you feel that there is more than one correct response, mark the response which you consider the most appropriate. In any case, choose ONLY ONE response for each item.
 - (B) Questions under **SECTION-B (Conventional method) and SECTION-C (Conventional method)** are to be answered in separate Answer Book.
4. You have to mark all your responses of **SECTION-A by Black Ball Point Pen only** on the separate OMR Answer Sheet provided. See directions in the Answer Sheet.
5. Before you proceed to mark in the Answer Sheet the responses to various items of **SECTION-A** in the Test Booklet, you have to fill in some particulars on the Answer Sheet.
6. On completion of the Examination, you should handover the OMR Answer Sheet for **SECTION-A** and Answer Book for **SECTION-B and C** to the invigilator only. You are permitted to take the Test Booklet with you.
7. Sheets for rough work are appended on the Test Booklet at the end.
8. **Instructions for wrong and multiple answer(s) SECTION-A :**
 - (a) There will be four alternatives for the answer to every question. However, there will be no negative marking for wrong answer.
 - (b) If a candidate gives more than one answer, it will be treated as a **Wrong Answer** even if one of the given answers happens to be correct.

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INSTRUCTIONS

1. There are a total of 60 questions. Q. Nos. 1-40 in SECTION-A are Multiple Choice Questions having 2 marks each.
2. In SECTION-B, there are 15 questions. Q. Nos. 41-55 of 6 marks each, answers to which is restricted to 40 words each.
3. In SECTION-C, there are 5 numerical questions. Q. Nos. 56-60 of 6 marks each.
4. All symbols used in the questions have their usual meanings.

SECTION—A

Example : Poise is the unit of

- (A) Surface tension (B) Buoyant force
☒ (C) Coefficient of viscosity (D) Gravitational force

Answer : ☒ (C) Coefficient of viscosity.

1. The temperature rise in a cable conductor depends on
 (A) the thickness of insulation
 (B) the cross-sectional area of the conductor
 (C) the length of the conductor
 (D) None of these
2. In DC machines, which of the following statements is correct about front pitch (y_f) and back pitch (y_b) of retrogressive lap winding ?
 (A) $y_f = y_b - 1$ (B) $y_f = y_b - 2$
 (C) $y_f = y_b + 1$ (D) $y_f = y_b + 2$
3. The frequency range in which ultra-high frequency oscillators operate is
 (A) 30 MHz–300 MHz (B) 3 GHz–30 GHz
 (C) 300 MHz–3 GHz (D) None of these

4. For a step-up DC-DC converter with a resistive load, the ripple current is given as
- (A) $\Delta I = \frac{V_s}{L} kT$ (B) $\Delta I = \frac{V_s}{T} kL$
 (C) $\Delta I = \frac{V_s}{LT} k$ (D) $\Delta I = \frac{V_s}{kL} T$
5. Reactive power can be injected into a transmission line by using
- (A) series capacitors (B) synchronous capacitors
 (C) shunt capacitors and reactors (D) None of these
6. A no volt coil is employed in a three-point starter in a DC machine to provide protection against
- (A) failure of armature current (B) failure of field current
 (C) failure of spring (D) failure of handle
7. The Colpitts oscillator can be converted to a Clapp oscillator by inserting a
- (A) small capacitance in series with the inductance L
 (B) large capacitance in series with the inductance L
 (C) small capacitance in parallel with the inductance L
 (D) large capacitance in parallel with the inductance L
8. Voltage regulation is the criterion used in the design of
- (A) feeders (B) transmission lines
 (C) transformers (D) alternators

9. In buck regulators, for continuous inductor current and capacitor voltage, the critical inductor (L_c) and critical capacitor (C_c) are

(A) $L_c = \frac{(1-k)R}{16f}$

(B) $L_c = \frac{(1-k)R}{16f^2}$

$C_c = \frac{(1-k)}{2Lf^2}$

$C_c = \frac{(1-k)}{2Lf}$

(C) $L_c = \frac{(1-k)R}{2f}$

(D) $L_c = \frac{(1-k)R}{2f^2}$

$C_c = \frac{(1-k)}{16Lf^2}$

$C_c = \frac{(1-k)}{16Lf}$

10. In 8085 microprocessor, which of the following instructions converts the contents of the accumulator to its binary coded decimal form ?

(A) DAD

(B) DAA

(C) DCR

(D) DCX

11. In alternators, the imaginary or fictitious part of synchronous reactance takes care of

(A) armature reaction

(B) inductive reactance

(C) voltage regulation

(D) copper losses

12. The hexadecimal equivalent to decimal 2470 is

(A) 8A5

(B) 8A6

(C) 9A5

(D) 9A6

13. The rate of rise of restriking voltage depends on

(A) circuit power factor only

(B) switching condition only

(C) Both (A) and (B)

(D) None of these

14. An alternator is said to be over-excited, if it is operating at
- (A) leading p.f.
 - (B) lagging p.f.
 - (C) unity p.f.
 - (D) Any of the three conditions in (A), (B), or (C)
15. Which of the following configurations provides maximum (gain $\times$ bandwidth) product ?
- (A) Common emitter amplifier
 - (B) Cascade amplifier
 - (C) Cascode amplifier
 - (D) Differential amplifier
16. In a NOR-gate RS flip-flop, with inputs $R = 0$, and $S = 0$, the output Q
- (A) will be set
 - (B) will be reset
 - (C) will remain unchanged
 - (D) None of these
17. The function of *armouring* provided by steel wires or tapes is to provide
- (A) protection against corrosion
 - (B) additional strength
 - (C) additional insulation
 - (D) additional mechanical protection sheath
18. Interpoles are used for
- (A) decreasing the counter e.m.f.
 - (B) increasing the speed of the motor
 - (C) converting armature current to DC
 - (D) reducing sparking at the commutator

19. The channel capacity of a band limited Gaussian channel is
- (A) $C = B \log_2 \left(1 + \frac{S}{N} \right)$ (B) $C = \frac{1}{B} \log_2 \left(1 + \frac{S}{N} \right)$
- (C) $C = B \log_2 \left(\frac{S}{N} \right)$ (D) $C = \frac{1}{B} \log_2 \left(\frac{S}{N} \right)$
20. Surge impedance of a single circuit transmission line is 400Ω . Surge impedance of a double circuit line of same type will be
- (A) 200Ω (B) 400Ω
- (C) 800Ω (D) 1600Ω
21. For a common-drain FET amplifier with $\mu = r_{dg_m}$, the voltage gain A_v , is given as
- (A) $A_v \approx \frac{\mu}{\mu - 1}$ (B) $A_v \approx \frac{\mu - 1}{\mu}$
- (C) $A_v \approx \frac{\mu}{\mu + 1}$ (D) $A_v \approx \frac{\mu + 1}{\mu}$
22. For a 4% drop in supply voltage, the torque of an induction motor decreases by
- (A) 16% (B) 8%
- (C) 4% (D) 2%
23. Which of the following statements is incorrect about a stationary random process ?
- (A) The zero frequency value of PSD is the total area under the graph of the autocorrelation function.
- (B) The PSD of a stationary process is always non-negative
- (C) The PSD of a stationary process is an even function of frequency
- (D) None of these

24. the radix of the octal system is
- (A) 4 (B) 8
- (C) 16 (D) 6
25. Charging current due to capacitance C when a single phase line is transmitting power at voltage V and angular frequency ω is
- (A) $\frac{j\omega V}{C}$ (B) $\frac{V}{j\omega C}$
- (C) $\frac{1}{j\omega CV}$ (D) $j\omega CV$
26. Synchronous wattage of an induction motor means
- (A) stator input in watts (B) rotor input in watts
- (C) rotor output in watts (D) shaft output in watts
27. In three-phase bridge inverters, the preferred control method is
- (A) 180° conduction (B) 120° conduction
- (C) 60° conduction (D) None of these
28. Which of the following is/are known as the asynchronous input/inputs of an edge-triggered D flip-flop?
- (A) PRESET only (B) CLEAR only
- (C) Both PRESET and CLEAR (D) None of these
29. A 100V carrier peak changes from 160V to 40V by a modulating signal, the modulation factor is
- (A) 0.3 (B) 0.5
- (C) 0.6 (D) 0.7

30. For a non-uniform quantizer more quantizing steps are used for signals of
- (A) low frequency (B) high amplitude
(C) low amplitude (D) high frequency
31. The demodulation of a delta modulated signal is achieved by
- (A) Integration (B) Differentiation
(C) Sampling (D) Band Pass filtering
32. Which one of the following modulation technique is most affected by noise ?
- (A) ASK (B) PSK
(C) FSK (D) MSK
33. A Single-phase current source inverter is connected with capacitive load only. The waveform of the output voltage across the capacitor for constant source current will be
- (A) Sine wave (B) Square wave
(C) Triangular wave (D) Step function
34. A modern power semiconductor device that combines the characteristics of BJT and MOSFET is
- (A) GTO (B) FCT
(C) MCT (D) IGBT
35. The reverse recovery time of a diode is $3 \mu\text{s}$ and rate of fall $\left(\frac{di}{dt}\right)$ is $30 \text{ A}/\mu\text{s}$. The stored charge of the diode is
- (A) $45 \mu\text{C}$ (B) $135 \mu\text{C}$
(C) $270 \mu\text{C}$ (D) $540 \mu\text{C}$

36. Which of the following configuration is used for both motoring and regenerative braking ?
- (A) First quadrant chopper (B) Second quadrant chopper
(C) Two quadrant chopper (D) Four quadrant chopper
37. In a 3-phase bridge rectifier circuit for HVDC transmission the ratio of output DC voltage to Input AC voltage is
- (A) 0.5 (B) 1.0
(C) $\sqrt{3}$ (D) 2
38. Modified McMurray full-bridge inverter work on
- (A) Voltage Commutation (B) Current Commutation
(C) Load Commutation (D) Complimentary Commutation
39. In the buck-boost converter, what is the maximum value of the switch utilization factor ?
- (A) 1.0 (B) 0.75
(C) 0.50 (D) 0.25
40. A half-wave rectifier circuit using ideal diode has an input voltage of $20 \sin \omega t$ volt. Then average and rms value of output-voltage respectively are
- (A) $\frac{10}{\pi}$ V and 5V (B) $\frac{20}{\pi}$ V and 5V
(C) $\frac{20}{\pi}$ V and 10V (D) $\frac{10}{\pi}$ V and 10V

SECTION – B

- Answer *all* questions. Each question carries 6 marks.

6×15=90

41. In DC machines, why equalizer rings are not needed in a wave winding ?
42. Why does ripple counter has a limit for its highest operating frequency ?
43. Why and how a buffer layer is created below the n-drift layer in a MOSFET ?
44. What happens when RIM and SIM instructions are executed in 8085 microprocessors ?
45. Why differential compound DC motors are rarely used in practice ?
46. Why, in practice, surge impedance load of a transmission line is always less than the rated capacity of the line ?
47. Why is SPWM technique modified in pulse-width-modulated inverters to apply the carrier wave during the first and last 60° intervals per half-cycle and what are the advantages achieved ?
48. Why de-emphasis employed in a superheterodyne FM receiver ?
49. Why and where are smoothing reactors utilized in HVDC transmission ?
50. Using Karnaugh's map simplify the function $f(x, y, z, w) = \sum(3, 8, 10, 11, 12, 14)$.
51. Define Radio frequency telemetry with an example. Also describe the noise and bandwidth restrictions in a telemetry system.
52. Explain the time division multiplexing as applied to telemetry in detail.
53. Describe the different modes of operation of a thyristor with the help of its static V-I characteristics.
54. What is a DC chopper ? Describe the various types of chopper configurations with appropriate diagrams whenever necessary.
55. What is the purpose of connecting diodes in antiparallel with thyristors in inverter circuits ? Explain how these diodes come into play.

SECTION - C

- Answer *all* questions. Each question carries 6 marks.

6×5=30

56. A 555 timer, running as an astable multivibrator, employs $R_A = 1000 \Omega$ and $R_S = 1200 \Omega$. What will be the value of the capacitance C needed to obtain a frequency of oscillation of 500 kHz?
57. A 60 kW, 240 V compound DC generator has $R_a = 0.03 \Omega$, $R_{se} = 0.003 \Omega$, and $R_f = 80 \Omega$. The brush contact drop $V_b = 2V$ (1 volt each brush). Compare the generator induced e.m.f. when fully loaded in (i) long shunt compound and (ii) short shunt compound.
58. For a single phase full-bridge inverter that controls the power in a resistive load, the nominal value of input DC voltage is 200 V and a uniform pulse width modulation with five pulses per half cycle is used. The width of each pulse employed is 35° for the required control.
- (i) Determine the r.m.s voltage of the load.
 - (ii) If the DC supply is increased by 10%, determine the pulse width to maintain the same load power.
 - (iii) Determine the minimum allowable limit of the DC input voltage, if the maximum possible pulse width is 40° .
59. The yearly duration curve of a certain plant can be considered as a straight line from 300 MW to 80 MW. Power is supplied with one generating unit of 200 MW capacity and two units of 100 MW capacity each. Determine : (i) Installed capacity. (ii) Load factor, (iii) Plant factor, (iv) Maximum demand, and (v) Utilization factor.
60. Find the carrier and modulating frequencies, the modulation index and the maximum deviation of the F.M. wave represented by : $e_{fm} = 12 \sin (6 \times 10^8 t + 5 \sin 1200 t)V$. What power will this F.M. wave dissipate in a 10Ω resistor?

(Space for rough work)